Documento de Trabajo

Trade Liberalization and Wage Inequality. Time Series Evidence from Chile.

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1. INTRODUCTION

The few last decades can be characterized, among other things, as a period of growing globalization of the economy and increasing inequalities (Fieleke, 1994). Then, a positive correlation between these two factors could suggest that restricting foreign trade is part of the solution to reduce wage inequality. In this context, evaluation of the effects trade liberalization on the wage distribution is needed to understand if this process can help an economy to solve its uneven wage distribution or if it causes an increasing gap.

For a two-good, two-factor economy of the HOS sort, the Stolper-Samuelson theorem (Stolper and Samuelson, 1941) asserts that an increase in the price of a commodity raises the real return to the factor used intensively in the production of that good, and lowers the real return of the other factor. If we take the two factors to be skilled and unskilled labor, and assume the country to be unskilled labor abundant, a reduction in trade barriers would be expected to produce an increase in the real wage of unskilled labor. This, in turn, should reduce the wage gap between skilled and unskilled labor.

In this paper, I analyze the Chilean case using Granger-causality tests between different wage inequality measures and a set of openness indicators (exports ratio, imports ratio, trade ratio, average tariff, and black market premium). International trade theory does not suggest a relationship between volume of trade or degree of liberalization and wage gap, but many empirical studies analyze this relationship. Additionally, I evaluate the relationship between terms of trade and wage gap, which is suggested by Stolper-Samuelson's theorem. I find that openness does not Granger-cause inequality, also I find some evidence of the presence of Stolper-Samuelson's effects in the Chilean data.

This paper is structured as follow. In the rest of this section, I review the studies that analyze the Chilean case. In section 3.2, I describe the data and methodology employed in this paper. Section 3.3 presents the results of the tests. Finally, final comments are in section 3.4.

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Most of the empirical work analyzes the U.S. case, where economists are trying to measure the impact of increased openness on the increasing wage gap. Many factors have been analyzed to explain this trend. Most of the attention has been focused on: Immigration of unskilled workers, changes in age composition (more young workers), changes in educational composition (less college graduates relative to high-school graduates in the labor force), organization of the labor force (less unionization), North-South trade, and technological change (Borjas and Ramey, 1994; Leamer, 1994; Fieleke, 1994). Researchers have found that only the last two factors can be responsible for the widened wage gap, but the discussion is far from being over. The empirical evidence of the role of U.S.' foreign trade on wage inequality goes from "*a giant sucking sound to a small hiccup"* (Lawrence and Slaughter, 1993).[1]

In the case of Latin American countries, there is little empirical evidence. These countries are characterized, among other things, by high levels of inequality, and liberalizing their foreign trade in the last decades. Theoretically, this process should help to reduce the differences, because the abundant factor is the unskilled labor.

Two studies analyze the role of liberalization on the evolution of wage inequality in Chile: Robbins (1995) and Meller and Tokman (1996).[2] In this country, a radical program of reforms was implemented in the mid-70s. The trade reform eliminated all non-tariff barriers and the tariffs were reduced from 100% on average to 10% flat in 1980. In the 1980s the level of the tariff increased after the 1982 economic crisis up to 35%, and after that started decreasing down to 11% in 1991. Additionally, incentives to exports were implemented.

Robbins (1995) estimates relative wages using earnings equations. Where Stolper-Samuelson's theorem predicts a narrowing of the wage distribution, he finds that wage inequality increased since 1975. Robbins (1995) evaluates if some alternative factors can explain the trend in wage distribution, such as relative labor supply changes, minimum wage, labor market reforms, etc., but none of them can do it. Therefore, he concludes that H-O-S effects were not present or were weak in the Chilean experience, and skill biased technical change can explain the trend of relative wage. However, there is not a specific analysis of the effects of relative commodity price on the relative wage as Stolper-Samuelson's theorem states.

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[1]Some empirical evidence for the U.S.: Borjas, Freeman, and Katz (1991), Murphy and Welch (1991), Gaston and Trefler (1992), Leamer (1992), Lawrence and Slaughter (1993), Borjas and Ramey (1994), Wood (1994), Bhagwati and Dehejia (1994), Baldwin and Cain (1995), and Leamer (1996).

[2]Other studies on Latin American countries are: Hanson and Harrison (1995) analyze the Mexican case, Saavedra (1996) studies the Peruvian case in the 1990s.

Meller and Tokman (1996) study the effect of the trade liberalization on the wage gap in the manufacturing sector, computing the relative wage from firm surveys. They find that the wage gap between blue collar and white collar workers increased after 1974. However, if the time period is restricted to the post external debt crisis (1984-1992) the inequality diminished. They try to test the Stolper-Samuelson theorem explicitly including, first, a dummy variable for the period of liberalization, and second, the relative price for each manufacture sector. The evidence is not conclusive. They argue that there are some problems with assumptions behind the estimated equation (relative supply of labor is assumed to be constant, when Robbins (1995) shows that increased) and endogeneity of left hand variable used in the estimation, among other problems.

2. DATA AND METHODOLOGY

I employ three types of data to analyze the period 1975-1992: relative wages, openness, and relative prices. Three different measures of relative wages are used. First, Robbins' (1995) measure of relative wage (RWAGE). He computed wage equations for each year using data from Metropolitan Santiago, then he estimated the wage for skilled and unskilled workers to obtain the relative wage, controlling for other variables. This particular measure has the advantage of controlling for variables such as sex and age which play an important role on wage. However, the data employed to estimate the wages cannot represent the national economy.[3] For this reason I employ more than one measure for relative wage. The second and third measures are used by Meller and Tokman (1996). The data include only the manufacture sector at the national level, separating the export sector (RWAGEXP) from the import competitive sector (RWAGIMP). The main problem with these indicators is the lack of control for other variables that have an effect on wages, which is taken into account in Robbins' measure. The survey is done by Instituto Nacional de Estadísticas.[4]

Table 3.1 presents the correlation between the three measures of relative wage. A significant positive correlation is found between RWAGEXP and the other two indicators. Only the correlation between RWAGIMP and RWAGE is positive, it is not significant.

[3]Santiago has a different production structure. Most of the new export activities developed after liberalization are located in the regions other than Santiago (production process), but the central offices are in the capital, were they need mostly skilled workers.

[4]See Meller and Tokman (1996) to detailed explanation of industry classification.

In the literature, different openness measures have been employed, mostly in testing the impact of openness on growth. Harrison (1996) and Leamer (1998) summarize the criticisms of the openness measures used in empirical work. All these measures are imperfect proxies for trade policy, therefore I employ as many openness measures as possible, as Harrison (1996) suggests. In this paper, I use the following indicators: export rate (EXPRATE = exports/GDP), import rate (IMPRATE = imports/GDP), trade rate (TRADERATE = exports+imports/GDP), and average tariff (TARIFF).

Table 3.2 shows the correlation between the openness measures. All of them are significant but the correlation between EXPRATE and IMPRATE, this could be a result of the different pattern of exports and imports after liberalization. The first years after the liberalization imports grew faster than exports, but after the debt crisis (1982) the trend was reversed. The correlation between TARIFF and EXPRATE is negative and significant, which could indicate that lowering tariffs the country increases exports as theory suggest, but correlation does not confirm causation.

Finally, the third type of data is the relative price. The Sloper-Samuelson theorem states a relationship between factor prices and commodity prices, then I employ the terms of trade (TERMTRADE) to measure the relative price of exports with respect to imports.

The paper uses time series analysis to draw conclusions about the impact of openness and relative price on wage gap. Granger-causality tests are perform for each pair of wage inequality and openness indicators. Additionally, the test is performed for all three measures of wage differentials and relative prices. Granger-causality tests no analyze the "philosophical" causation between the variables, but it is an econometric tool available to find direction of causation to improve forecasts. It does not have an economic model which suggests the relationship to be tested between openness and wage gap. There is not a theory that states a causation from openness to relative wages, however it has been studied empirically using different methods, which have a theoretical model behind, then, Granger-causality is tested using the following representation:[5]

$$W_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i * W_{t-i} + \sum_{i=1}^{q} \beta_i * X_{t-i} \qquad (1)$$

where W is the ratio of skilled-workers' wage to unskilled-workers' wage. X is the openness measure or relative price. p and q are the optimal lags chosen according to

[5]All variables were found to be stationary, therefore the equation can be estimated in levels.

AIC and Schwarz criterion, if the optimal lag differs both equations are estimated. Granger-causality tests the significance of all lagged values of X included in equation (1). If the null hypothesis all βs are equal to zero is rejected, X does Granger-cause W. In the cases where X does Granger-causes W, impulse response and variance decomposition are analyzed.

3. RESULTS

A preliminary analysis of the data is presented in Table 3.3. On the one hand, the increasing inequality and liberalization is found using the correlation coefficient between the relative wage and openness measures. EXPRATE and TRADERATE are strongly positive correlated with all three measures of relative wage, while TARIFF is highly negative correlated with wage inequality in two out of three cases. However, this should not be used to draw any conclusion, since correlation is not sufficient to imply causation. On the other hand, the correlation between relative price and relative wage measures is significantly negative. As the terms of trade improved wage inequality decreased, which suggests that Stolper-Samuelson effects are present in the Chilean case.

The results of Granger causality tests between the openness measures and relative wages are in Table 3.4. Different lag-lengths are used since Akaike Information Criterion and Schwarz Criterion give different answers. In general, openness does not Granger-cause wage inequality.

Only in two cases is causation found. First, EXPRATE does Granger-cause RWAGE, being significant at the 3% level, when two lags are included. Figure 3.1.a shows that the impact of EXPRATE on RWAGE is positive, thus as the country is more open, the wage gap increased. However analyzing the variance decomposition (Figure 3.3.a), EXPRATE explains less than 20% of RWAGE variance. Therefore, openness, using as measure the ratio of exports to GDP, does increase the wage inequality in the Chilean case, but it does not appear to be the most important factor.

This result can be explained by the nature of the Robbins' measure of wage inequality. Only data from Metropolitan Santiago was employed to compute the relative wage, which can lead us to the conclusion that liberalization has increased the wage gap. instead of reducing it as Stolper-Samuelson theorem predicts. Most of the production of exportable is not located in Santiago, but most of the companies have their central office in the Metropolitan Santiago. So, they demand relatively more skilled workers than unskilled workers in Santiago, because only the central administration operations are located in there.

Second, TARIFF does Granger-cause RWAGIMP, at the 5% level including 2 lags in the relative wage equation. Panel (b) of figure 3.1 shows the response of RWAGIMP to one standard deviation innovation in TARIFF. In the graph can be seen that the effect is positive in the first three years and then disappears. Therefore, as the country cuts tariffs- liberalize foreign trade- wage inequality diminishes. In panel (b) of figure 3.3, the variance decomposition is presented. It shows that between 30-50% of RWAGIMP variance is due to TARIFF.

This finding suggests the present of Stolper-Samuelson effect in Chile after the reforms. Cutting tariff reduces price distorsion, diminishing the relative price of import competitive goods. Therefore, the relative wage of skilled workers goes down, because import competitive industry is intensive in that factor. However, a similar result is not found in the exports sector.

Therefore, openness measures do not seem to be Granger-causing the wage gap. Out of 12 cases, only in two did I find causation. However, the result is not conclusive. If openness is measured using the exports ratio to GDP, the conclusion is openness increases inequality, while if average tariff is used to measure openness, the result goes in the other direction.

Analyzing the relationship between relative wages and relative prices, the evidence is also weak, but confirms the prediction made by Stolper-Samuelson's theorem. Table 3.5 presents the results of Granger-causality tests between the terms of trade and the three indicators of relative wage. Only in one case causation is found. TERMTRADE does Granger-cause RWAGEXP at the 10% significance level, when 1 lag is included. As figure 3.2 shows the relative wage responds negatively to a one standard deviation innovation in the terms of trade. Then, as relative price increases, the wage gap decreases which is predicted by Stolper-Samuelson's theorem. However, figure 3.4 shows that just 0 to 20% of RWAGEXP variance is explained by TERMTRADE.

In the RWAGE and RWAGIMP, TERMTRADE does not Granger-cause them, however the impact of relative price is negative as in the case of RWAGEXP. Granger-causality test is not the best technique to evaluate Stolper-Samuelson's theorem (the objective of this paper is mainly analyze the relationship between openness and relative wage). The theorem states a contemporaneous relationship between commodity price and wage gap, which is not captured by Granger-causality tests.

4. FINAL COMMENTS

The effect of trade liberalization on the wage inequality has not been studied extensively in developing economies. Some of the empirical work suggest the absence

of Stoper-Samuelson's effects, because there is a positive correlation between increasing openness and the wage gap, although the relationship is through commodities prices.

In this paper, I show that although there is a significant correlation between different openness measures and relative wage, causation is rarely found. Moreover, in the two cases where openness Granger-causes wage inequality the impact works in different direction. Exports rate increases the wage gap, while reduction of tariff decreases inequality.

If the presence of Stolper-Samuelson's effects are going to be study, the explicit relationship between relative price and relative wage should be analyzed. I found weak evidence that Stolper-Samuelson is present in the Chilean case.

The next step should be a explicit test of Stolper-Samuelson's theorem as suggested by Baldwin and Cain (1995) and Leamer (1996), where predicted changes in relative wage is compared with actual changes to evaluate the presence or absence of Stolper-Samuelson's effects.

TABLE 3.1: Correlation for Relative Wage Measures. 1975-1992

	RWAGE	RWAGEXP	RWAGIMP
RWAGE	**1.00**	**0.73*** **	**0.42**
RWAGEXP	**---**	**1.00**	**0.77*** **
RWAGIMP	**---**	**---**	**1.00**

*** indicates significant at 1% level.

TABLE 3.2: Correlation for Openness Measures.

1975-1992

	EXPRATE	IMPRATE	TRADERATE	TARIFF
EXPRATE	**1.00**	**0.35**	**0.83*** **	**-0.50** **
IMPRATE	**---**	**1.00**	**0.88*** **	**-0.79*** **
TRADERATE	**---**	**---**	**1.00**	**-0.78*** **
TARIFF	**---**	**---**	**---**	**1.00**

*** indicates significant at 1% level. ** indicates significant at 5% level.

TABLE 3.3: Correlation between Relative Wage Measures and Openness and Relative Price. 1975-1992

	RWAGE	RWAGEXP	RWAGIMP
EXPRATE	**0.77*** **	**0.61*** **	**0.53** **
IMPRATE	**0.44***	**0.47***	**0.34**
TRADERATE	**0.73*** **	**0.65*** **	**0.53** **
TARIFF	**-0.57** **	**-0.60*** **	**-0.38**
TERMTRADE	**-0.52** **	**-0.64*** **	**-0.76*** **

*** indicates significant at 1% level. ** indicates significant at 5% level. * indicates significant at 1% level.

TABLE 3.4: Granger Causality Test between Relative Wage and Openness Measures. p-values (1975-1992)

	RWAGE	RWAGEXP	RWAGIMP
EXPRATE	**0.025 (2)** 0.351 (4)	0.158 (1) 0.173 (3)	0.743 (1) 0.698 (2)
IMPRATE	0.630 (2) 0.617 (4)	0.694 (2)	0.703 (2)
TRADERATE	0.908 (2) 0.879 (4)	0.855 (1) 0.852 (2)	0.588 (1) 0.690 (2)
TARIFF	0.576 (3)	0.349 (2)	**0.042 (2)**

In parenthesis is the number of lags used in test. First row according to AIC, second row according to Schwarz criterion

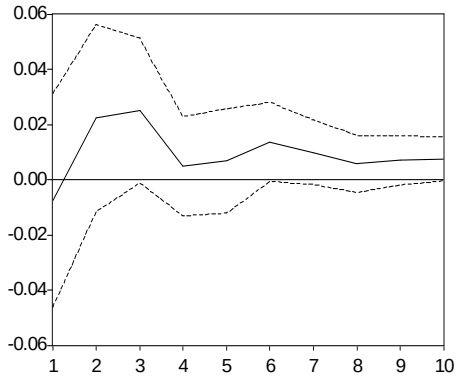
TABLE 3.5: Granger Causality Test between Relative Wage and Relative Price. p-values (1975-1992)

	RWAGE	RWAGEXP	RWAGIMP
TERMTRADE	0.305 (3) 0.634 (4)	**0.072 (1)**	0.350 (2)

In parenthesis is the number of lags used in test. First row according to AIC, second row according to Schwarz criterion.

FIGURE 3.1: Impulse Response Function for Openness Measures

a) Response to One S.D. Innovations ± 2 S.E.
Response of RWAGE to EXPRATE



b) Response to One S.D. Innovations ± 2 S.E.
Response of RWAGIMP to TARIFF

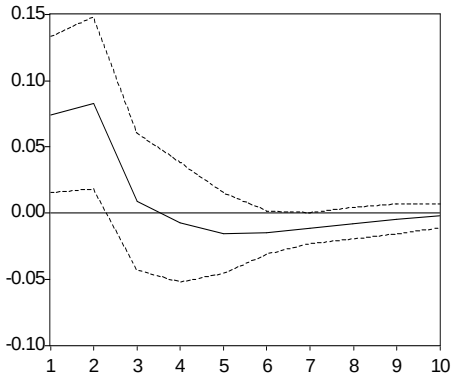


FIGURE 3.2: Impulse Response Function for Relative Price

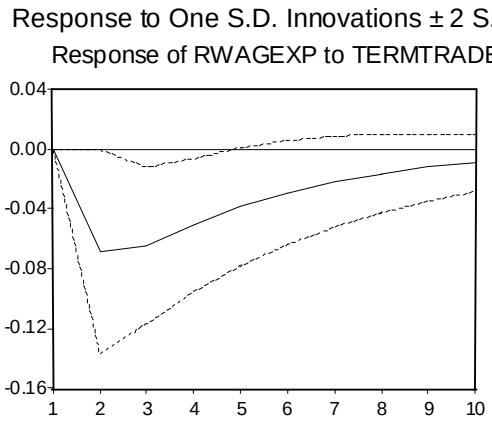
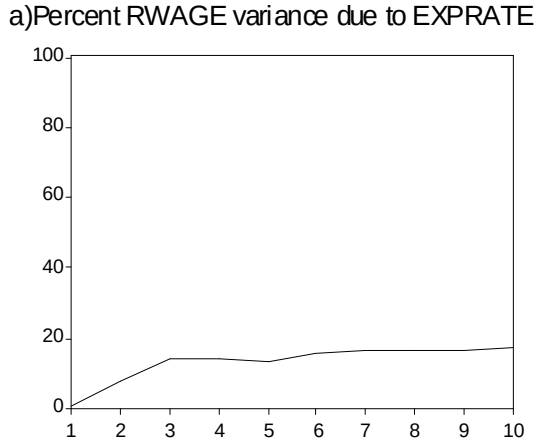


FIGURE 3.3: Variance Decomposition for Openness Measures



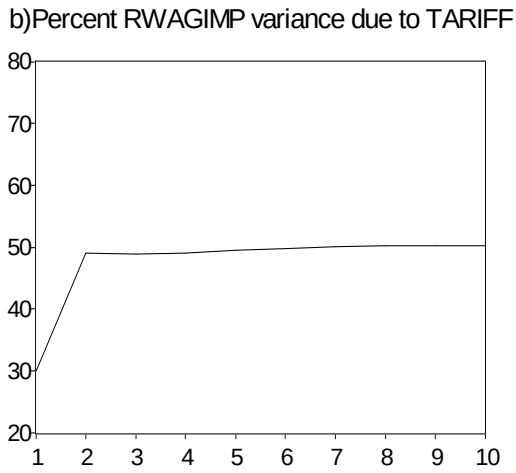


FIGURE 3.4: Variance Decomposition for Relative Price.